

Notes on the Oak-feeding Species of
Phyllonorycter Hübner (Lep.: Gracillariidae)

By A. M. EMMET*

(1) *Phyllonorycter muelleriella* Zeller (*amyotella* Duponchel). In my recent paper on this species (Emmet, 1974), the records I gave for Gloucestershire were old and uncertain. Mr. Leslie Price of Stroud has been prompted to send me particulars of more recent captures not hitherto published as he was unaware that the moth was so local. They are given here with his permission. During the years 1954, 1955 and 1964 he took eight specimens in the county. Seven of these were from the Forest of Dean (Speech House and Cannop Ponds) and one from Dymock. This last locality is only a mile or two from the border with Herefordshire, and only a little further from Worcester-shire, so it is likely that the range of the moth extends into both these counties. Mr. Price's specimens were all taken as adults; he found one resting on a tree trunk and disturbed the others from foliage. Mr. D. W. H. Fennell bred the species in 1974 from Linton, near Dymock.

I have also received additional north-western records from Dr. R. Askew and Dr. M. Shaw of Manchester University, who have bred *Phyllonorycter* imagines in the course of their research into their parasites. Their specimens are from three localities: (a) Delamere Forest, Cheshire, from a mine on *Quercus robur* or *Q. petraea* collected on 29.x.1969. This seems to constitute a new county record. (b) Between Newby Bridge and Hawkshead, North Lancashire (Cumbria), from a mine on *Q. petraea* collected on 8th October, 1970. (c) A locality not precisely specified in the Lake District, Westmorland (Cumbria), from a mine on *Q. petraea*.

(2) *P. quercifoliella* Zeller and *P. harrisella* Linnaeus. After the specimens of *muelleriella* had been extracted from the Manchester consignment, there were exactly one hundred moths left. The following figures are therefore both actual and percentages. There were 49 *harrisella* and 29 *quercifoliella*: in the south of England *quercifoliella* is usually the more plentiful species.

(3) *P. heegeriella* Zeller. The remaining 22 moths from Manchester belonged to this species, about half of them being of a form which appears to be peculiar to the north-western counties. The typical form has the basal two-fifths of the wing clear, shining white and the outer three-fifths pale golden. There is a blackish fuscous basal streak to two-fifths. This springs from the base of the costa and not, as is usual in the species of the genus possessing this character, from the centre of the wing base; Bradley, Jacobs and Tremewan (1969) show this streak distinctly too low in their figure and Jacobs (1945) errs slightly in the same direction. The streak is obscurely edged above with pale golden. There are four costal and three dorsal wedge-shaped white strigulae, inwardly edged with sharply defined lines of blackish fuscous. The north-western form has a very different

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appearance. The ground colour of the whole forewing is dull golden, but the tips of the scales are so broadly greyish fuscous as almost to obscure their golden bases, and this latter colour can only be seen in many specimens under magnification. The dark-tipped scales give the wings a coarse, roughened appearance. There is a broad, centrally placed *white* basal streak, diffusely edged above with dark fuscous, an effect produced by an intensification of the darkening of the scale tips. This obscure dark line corresponds with the clearly defined blackish basal streak of the typical form and it now becomes clear why the latter is situated so close to the costa. The dark edging of the costal and dorsal strigulae is likewise blurred and tends to merge into the apparent ground colour. Whereas the typical *heegeriella* appears as an inwardly white and outwardly pale golden insect with sharp black markings, the north-western form shows as a uniformly greyish moth with diffused white markings. It is much less beautiful and somewhat resembles a small and shabby specimen of *P. distentella* Zeller (Jacobs, 1945, Pl. 3, fig. B1); in fact when I reared this form from Arnside Knott, Westmorland, I at first thought it was that insect, as did Mr. Jacobs momentarily, when I showed him the specimen. There are examples of this form, taken in Lancashire and Westmorland by Threlfall and Hodgkinson, in the Bankes collection at the British Museum (Natural History). Intermediate forms occur. So far as I know, this form has not hitherto been described.

(4) *P. distentella* Zeller. Meyrick (1928) mentions only Herefordshire in giving the distribution of this moth, and it still occurs in that county, for a specimen was taken there in 1974. Does it not occur elsewhere in Britain?¹

(5) *P. messaniella* Zeller. There is a mystery concerning the winter behaviour of that large element of this species which we find feeding on deciduous trees (cf. Emmet, 1970). The principal foodplant is the evergreen holm oak (*Quercus ilex*) and here there are no problems. The moth has three generations, the last of them providing adults in October and November. The autumnal females lay their eggs on the leaves of their foodplant in the normal way, and the ensuing larvae feed up during the winter, faster or slower according to temperature, thus becoming full-fed as early as February, or as late as April. But during the summer months larvae are also to be found on deciduous foodplants such as oaks (*Quercus robur*, *Q. pretraea*, and *Q. cerris*), beech, including copper beech, hornbeam, sweet chestnut and even lime (*teste* D. W. H. Fennell (1974) though his larvae jibbed at this foodplant and the adult failed to emerge properly). The puzzling factor is that larvae in this category sometimes occur at such great distances from holm oaks that spring dispersal from that tree can almost be discounted. For example, in July 1974 I collected mines yielding *messaniella* on *Q. robur*

¹ The late H. W. Daltry states (*Entomologist*, 69: 114) that in 1935 he took the imago of *distentella* in Blean Woods, Kent, but we are unaware of any other record of the occurrence of this species outside Herefordshire.—Editor.

at Ballynahinch and Clifden in Co. Galway; these localities, about ten miles apart, are situated close to the Atlantic seaboard and about 50 miles west of Galway city. The nearest recorded holm oaks are in south Kerry (Perring and Walters, 1963). My enquiries failed to elicit any information of more local examples in parks or gardens, though I did find one nearer than those shown in the Botanical Atlas; this was at Tralee in north Kerry, 90 miles away in a line lying mostly over Atlantic waters. Well, of course there may be an odd holm oak growing undetected less far from Ballynahinch, but this would not refute the general drift of my argument, that *messaniella* does occur, even commonly, far from any evergreen oak, leading one to suppose that it can subsist independently of that tree. To do this, some measure of adaptation would be necessary. Let us consider the possibilities.

(a) If the moth can disperse up to one hundred miles from its host tree, its progeny might be equally capable of returning thither. This theory presupposes that *messaniella* possesses a mechanism similar to that of *Danaus plexippus* Linnaeus, a species breeding in Canada and overwintering in California; succeeding generations are able to find their way to the self-same tree as that occupied for hibernation by their parents. The weakness of this supposition is that *messaniella* is too frail an insect to be able to cope competently with long journeys; its performance against a head-wind would be abysmal.

(b) The autumnal female could lay her eggs on buds or twigs and their hatching could be delayed until the sprouting of the spring foliage. There is no precedent for such behaviour within the genus, for the larvae mine from their ova direct into leaves or stems; they are not adapted to wander in search of their food.

(c) The insect could overwinter within the fallen leaf, either as a full-fed larva or a pupa. This is its obvious course, for such is the behaviour of the bulk of its congeners. But if it did this, we should rear *messaniella* along with *quercifoliella* and the rest of the oak-feeding *Phyllonorycter* species, from the leaves we pick from the trees in the autumn or gather up from the ground in the winter; I have never heard of this being accomplished.

(d) The adult female, if she cannot find suitable leaves on which to lay in the autumn, might overwinter like *P. comparella* Zeller and oviposit on the new foliage in the spring, some five or six months after her evergreen-based relatives have died, their duty done. If she could do this, she would surely turn up on mild nights in collectors' light traps during the early months of the year, for the species is certainly attracted to light. I have heard of no such capture.

(e) There might be an alternative evergreen foodplant utilised in winter where holm oak is not available. But it is almost inconceivable that the conspicuous mines of such a common moth should escape the questing eyes of an entomologist bent on winter fieldwork.

(f) The larva might feed on a different part of the tree in winter, just as *Etainia sericopeza* Zeller feeds on the keys and seeds of Norway maple (*Acer platanoides*) in summer, but under the bark of twigs and in leaf-buds in winter (Emmet, 1973). On the face of it, it seems an impossible course for a *Phyllonorycter*, but who would have suspected *sericopeza* of living a double life? The life history of *P. ulicicolella* Stainton and *P. scopariella* Zeller demonstrate that the mining of tender bark is possible for the genus.

(g) Finally we are faced with the possibility that the moth is migratory in a self-destructive way, temporarily colonising localities where it has no hope of winter survival. The distance it apparently travels from base, the regularity with which it reappears in far-flung localities, and its abundance are arguments against this option, but nevertheless, it seems to be the least impossible among the unlikelihoods I have listed.

Stainton (1857) wrote of *messaniella*: "It is not very creditable to English entomologists that one of the very commonest of our insects should have been first described by a German from specimens he took when visiting Sicily." If we can solve the problem of its winter purveyance, we may be able to lift our heads again.

(6) *P. lautella* Zeller. Meyrick (1928) adds a postscript after his entry for this species: "The Scotch form is sometimes even dark bronzy-fuscous." This dark form was formerly supposed to be a separate species under the name *irradiella* Scott. Thus Stainton (1857 and 1859) accords it specific status and cites Scarborough and Renfrew as its localities. Morris (1872) repeats these localities and adds Beckenham and Dublin. However, neither Jacobs (1945) nor Bradley, Jacobs and Tremewan (1969) make any mention of this very distinct form.

I have bred *f. irradiella* (but not the typical form) from Ballynahinch and there are examples of it in the British Museum (Natural History) from North Wales, presented by Mr. H. N. Michaelis. Mr. Jacobs has reared it from (Bromley) Kent mines (compare Morris's record from Beckenham). So the dark form is not exclusively Scottish though the evidence suggests that it occurs more frequently in the north and west. Work needs to be done on recording the distribution of the two forms and ascertaining the extent to which they overlap.

(7) *P. roboris* Zeller. My wife netted a specimen of this rare species on 15th June, 1974 in Herefordshire, and I bred two more from a handful of mines collected on 16th November in the same locality. The mined leaves were brought indoors in late January and the imagines emerged in mid-March, about a fortnight after the commoner species in the same material had ceased to come out. Mr. E. C. Pelham-Clinton, who has visited the same wood in quest of this species, has very tentatively suggested that it may be univoltine. When entomological time was young, collectors in Britain and on the continent interchanged their information freely. Consequently it was natural for writers such as Stainton to supplement their imperfect know-

ledge of a species newly found in Britain with information gleaned from abroad; thus continental voltinism was sometimes attributed to a species without proof that it followed the same regime in this country. If (it is a big "if") *roboris* is univoltine in Britain, it would explain (a) the relatively late date of the specimen taken by my wife; (b) the relatively late date of the emergence of the bred specimens; and (c) the absence of *roboris* from the much larger sample of mined oak leaves which I collected at the Herefordshire locality on 17th July, 1974. A collector has only to say that he has bred *roboris* from mines collected in July to disprove this supposition.

The differences described below between the mines of *roboris* and the other oak-feeding species of *Phyllonorycter* are based on my own observations together with those of Jacobs (1945), Hering (1957) and Mr. D. W. H. Fennell who has also bred *roboris* from mines collected in Herefordshire in the autumn of 1974. The mine is relatively large and is frequently placed near the petiole, where it extends from the midrib to the leaf margin. The completed mine is strongly arched. At the summit of the arch on the upper side there is a large green patch where the parenchyma has not been eaten, and it will shortly be seen that this area has been left for a purpose. Surrounding this patch the surface has a marbled aspect due to smaller uneaten spots of green. The lower surface of the mine usually lacks the longitudinal fold present with other species. When it spins its cocoon, *roboris* differs, as it makes no use of its frass to reinforce the construction; instead it spins a stout, parchment-like cocoon against the green, uneaten blob on the top of the mine. When mined leaves containing pupae of the other species are held up to the light, the frass-lined cocoons are clearly visible; however, if a mine of *roboris* is examined in the same way, it is found to be completely opaque, and nothing within is to be observed. Although there is no contact between the cocoon and the lower surface of the leaf, on eclosion the pupa projects through the lower epidermis like that of other species; whereas the exuviae of the latter are pale olive or reddish brown, those of *roboris* are readily distinguishable, being of a dark, blackish hue.

(8) *P. saportella* Duponchel (*hortella* Fabricius). I mention this species only to be comprehensive. Apart from stating that it seems very scarce and elusive and that little has been heard of it recently, I have nothing to communicate. Perhaps some collector with up-to-date experience of it may care to contribute his information.

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Further Notes on the Oak-feeding Species of *Phyllonorycter* Hübner (Lep.: Gracillariidae)

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Since 1968 I have been collecting *Phyllonorycter* mines on oak from various localities in Herefordshire in search of the rarer species, though only in the last two years have I met with success, for reasons which I will discuss later. Accordingly, Colonel Emmet's paper on this subject in this issue sent me scurrying to my notebooks to see whether I could throw any further light on the question of voltinism in these species.

The following table gives the dates of emergence of the various species bred in 1974 and 1975. Since the mines from the different localities were brought into the warm on different dates, there is no significance in the actual emergence dates, but only in the sequence of emergence in any one locality.

1973/74	Linton Map Ref. SO/6525	<i>P. harrisella</i> (Linn.) <i>P. quercifoliella</i> (Zell.) <i>P. muelleriella</i> (Zell.)	Mar. 17 Mar. 8, 16(2), 17 Apr. 15
1974/75	Linton. Map Ref. As above	<i>P. harrisella</i> <i>P. heegeriella</i> (Zell.) <i>P. quercifoliella</i> <i>P. muelleriella</i> <i>P. distentella</i> (Zell.)	Apr. 19 Apr. 12(2), 15, 17, 18 Mar. 31, Apr. 9(3) Apr. 11, 20 Apr. 11, 12
	Monnington. Map Ref. SO/3544	<i>P. roboris</i> (Zell.) <i>P. quercifoliella</i>	Mar. 27 Mar. 23, 26(2) 31, Apr. 1
	Woolhope. Map Ref. SO/6135	<i>P. roboris</i> <i>P. harrisella</i>	Mar. 28 Apr. 6
	Hough Wood. Map Ref. SO/5936	<i>P. roboris</i> <i>P. harrisella</i> <i>P. heegeriella</i> <i>P. quercifoliella</i>	Apr. 2, 10, 16(2) Apr. 6, 14, 18 Apr. 15, 19, 27 Mar. 27, Apr. 4, 5, 6, 14

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